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Public attitudes to technological risk: the contribution of survey data to public policy-making

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ABSTRACT. A growth in public awareness and concern over the hazards caused by technological and industrial development has become increasingly evident during the last two decades. Equally, it is now more widely accepted by regulatory authorities that public attitudes should form an essential part of the decision-making process over specific risks. This paper considers the value of attitudinal survey data in reflecting public concern and in informing policies for hazard control. Following a brief review of the relevant literature on risk perception, the example of one attitudinal survey is offered as a basis for discussion. This survey was conducted within the Halton area of North West England focusing in particular on chemical and road traffic hazards. The Halton example allows a wider consideration of the possible pitfalls and dangers, as well as the advantages, of attitudinal surveys in public policy terms. The discussion also considers the nature of risk perception as a concept and as a guide to public acceptability. Finally, it is argued that such evidence can be invaluable provided it is used to stimulate rather than stifle informed debate. However, the production of 'usable' knowledge may involve a changing role for both researchers and decision-makers.

KEY WORDS: Technological risk, Attitudinal surveys, Public policy-making, Halton, Risk evaluation.

One general conclusion which has been drawn from recent debates over technological risk¹ (for example, nuclear power, toxic chemicals or major hazards) is that the overall Risk Assessment process can be divided into two relatively distinct stages. On the one hand, there is the technically-based and apparently objective phase known as 'Risk Analysis' which utilizes mathematical and engineering techniques so as to quantify both the potential consequences of an accident and their probability of occurrence. On the other hand, there is the social, political and ethical process of 'Risk Evaluation', where a balance is attempted between the costs of a technology (in terms of human health and safety) and the benefits (often economic) of its propagation. Much has been written about Risk Assessment but the intention of this paper is to focus on one, especially vexed, facet of the process.

Whilst many aspects of Risk Assessment are open to legitimate doubt and scrutiny (for example, the relationship between risk analytical data and public policy-making),² one crucial topic of debate has been the value of survey evidence in reflecting public attitudes towards risk, and in feeding such data into decision-making processes. Although there is now a general acceptance among regulatory authorities that public opinions and attitudes need to be included

in the evaluation of risks, considerable scepticism has been expressed about the ability of questionnaire-based information to meet this need. One especially vivid demonstration of this official scepticism was Justice Parker's statement in his Windscale report that 'no weight at all can be given to the results of a number of opinion polls. . . to which I was referred'.³ Similarly, Sir Frederick Warner has argued that 'given the variations of opinion that occur even over a period of months, one could not justify basing long-term decisions on such changeable information'.⁴ It may well be that this uncertainty over attitudinal evidence is linked to the complexity of the 'risk evaluation' process as a whole; 'public opinion' can alter rapidly and it is often difficult to detect any underlying trends or patterns. In the legalistic forum of inquiries into specific forms of risk—such as those at Windscale or Canvey Island—survey data may also appear weak and impressionistic. Furthermore, there is often considerable doubt as to the status of such evidence—any disparity between 'actual' (i.e., measured) risks and 'perceived' risks could be taken as an indication of public irrationality rather than as a key input to the decision making process. Doubts can also be expressed about the precise relevance of attitudinal studies and their significance for the particular industrial development or planning application under discussion.

In sharp contrast to such critical views, it is not surprising to discover a number of social scientists arguing strongly for the validity of attitudinal data in considering the preferences and concerns of a diverse, and frequently divided, 'general public'.⁵ Surveys seem to offer a way of taking into account not just the views of highly motivated and unusually articulate 'public interest' groups (who can represent only themselves and are predominantly middle-class in nature),⁶ but also those of a wider population who may feel alienated from decision-making and whose opinions might otherwise be ignored. At the same time, it must be recognized by those actually involved in collecting survey evidence that the social assessment of risk is far from easy to quantify in a meaningful fashion. Matters of attitude and perception are difficult to express and record. The classification schemes for processing responses can have a substantial impact on final results. Many of these methodological problems are, of course, common to all forms of social survey, but 'riskiness' and the associated notion of probability of fatality or injury do seem especially problematic concepts for survey participants to articulate spontaneously. There may, therefore, be a considerable gap between the interpretation put on such terms as 'risk', 'hazard' or 'probability' by respondents and researchers.

Unfortunately, there is not the space here to conduct an adequate review of research into the public's attitudes towards various hazards. Nevertheless, it should be pointed out that some notable studies have already been conducted e.g., those by Auliciems and Burton,⁷ Dworkin and Pijawka,⁸ Johnston and Hay,⁹ Frederickson and Magnas,¹⁰ Swan¹¹ and Wall.¹² However, much of this material concerns itself with the nuisance value of pollution and its effects on amenity rather than the threat to human health and safety. A number of studies have also focused on technological hazards with a special interest being the debate over alternative energy systems and, in particular, public attitudes towards nuclear risks.¹³ On a more general level, the work of Tversky and Kahnemann has also been extensively drawn upon by researchers in the area of risk perception.

Tversky and Kahnemann have attempted to explain biases in probability judgement by identifying three major 'heuristic principles' which underlie these sources of error. A heuristic principle (or 'heuristic') is defined as a method of reducing a complex task (in this case assessing probability) to simpler judgemental operations. The first heuristic is 'representativeness': probabilities are frequently estimated according to the degree to which A resembles B. This principle leads to an insensitivity to the prior probability of outcomes and also to such matters as sample size. The 'gambler's fallacy', can also be accommodated within 'representativeness';

After observing a long run of red on the roulette wheel, for example, most people erroneously believe that black is now due, presumably because the occurrence of black will result in a more representative sequence than the occurrence of an additional red. . . In fact, deviations are not 'corrected' as a chance process unfolds, they are merely diluted.¹⁴

The second of these heuristics is 'availability' where a higher probability will be assigned to an event if an example of its occurrence can easily be brought to mind. Well publicized or dramatic causes of death—such as a murder or airline disasters—will thus be seen as more likely to occur than statistically greater but perhaps 'mundane' causes such as road accidents or diabetes. This heuristic also attracts attention to the significance of the mass media in portraying certain events (e.g., accidents such as Flixborough (1974), Stalybridge (1981) or Salford (1982)) and so increasing their 'availability'. The third principle is 'adjustment and anchoring': it seems that we are heavily influenced by our initial assessment of a probability and will cling to this despite the subsequent emergence of new information and changing circumstances. Whilst this is an obvious handicap for the development of public views towards specific hazards, there seems no reason why regulatory authorities and technical experts should themselves be immune from this source of bias.

Other biases of this sort have been described by Slovic, Lichtenstein and Fischhoff¹⁵ and they serve to remind us of the difficulties involved in 'facing up to uncertainty'. The more particular intention in describing them here is to characterize the problems of regulatory authorities (who are, as we have suggested, liable themselves to 'cognitive biases') in evaluating what might well be a morass of contradictory evidence concerning individual assessments and prejudices. Can attitudinal surveys traverse this minefield of personal idiosyncracies and still provide the decision maker with something of real value? The example of one such survey will be described here so as to discuss this important question.

THE HALTON SURVEY

The study in question¹⁶ focused on an area which has long been the centre of North West England's chemical industry. (See Fig. 1). At present, a number of different chemical processes are concentrated in the region of Halton and the hazardous materials used include ammonia, liquid oxygen, chlorine, propylene, vinyl chloride, toluene, paraquat and ethylene. The location of major hazard installations within the town is such that over 50 000 people live within a two kilometre radius of a major hazard, which amounts, in fact, to approximately 42 per cent of the town's population.¹⁷ However, this does not take into account those people who are put at risk due to the transport of hazardous materials by road, rail and pipeline within the area. More general problems of road traffic safety can also be identified in Halton with the town being located between the M62 and M56 motorway systems. Furthermore, major roads in the area are often used as access routes for the chemical industry's tanker traffic. For the purposes of this research it was decided to focus primarily on road traffic accidents and the hazards posed by the chemical industry. Two areas within Halton were selected which experienced a wide variety of environmental impacts from both traffic and the chemical industry. A ten per cent sample of these two areas was then randomly selected—this amounted to some two hundred people. The design of the survey was carried out according to guidelines suggested by Moser and Kelton.¹⁸ The questionnaire was prepared so as to examine the relationships between the attitudes towards risk expressed by respondents and their demographic, socio-economic and environmental characteristics. The questionnaire was structured in such a way that the attitudes of the respondents towards the general conditions of their areas, both

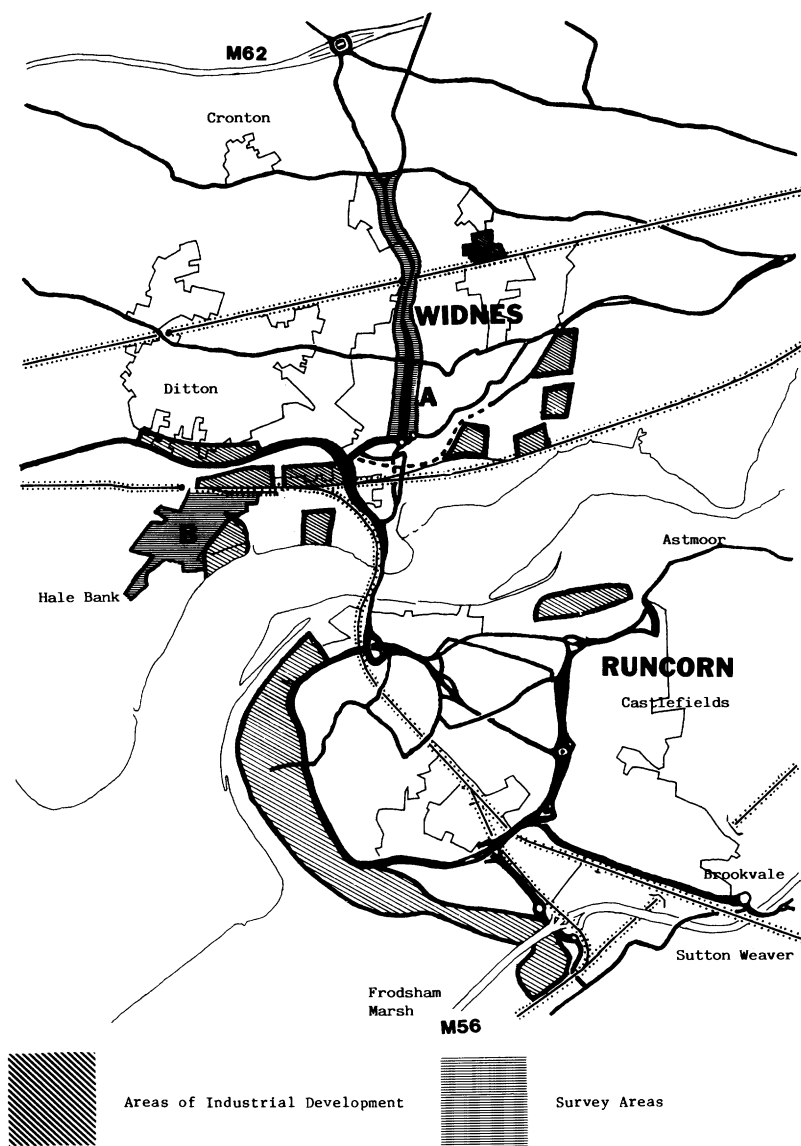


FIGURE 1. The Halton region of North-West England

social and environmental, were examined first of all. This was followed by an examination of their attitudes towards the specific risks from both industry and transport in their area.

In neither of the two areas within Halton did the risks associated with factory accidents emerge as a major source of concern among respondents. Whilst it was found that some people were concerned about the risk of traffic accidents it was only ranked eighth for the sample as a whole. However, one question gave the respondents a list of problems and asked them if they were a cause of anxiety. It was not too surprising to discover that inflation and unemployment were major concerns, especially during a recession. However, it was interesting to find that people were very concerned, when thus prompted, about the risk of traffic accidents (ranked

second overall). The results of the survey showed that in both the selected areas there was a appreciable percentage of respondents who were concerned about the specific risks of road traffic accidents once *specifically prompted* (approximately 65 per cent). Furthermore, levels of concern appeared, perhaps not surprisingly, to be related to the density and type of the traffic so that greater emphasis was given to this hazard in the area where the density of road tankers was at its highest. Certain generalizations could also be made about the respondents who were most concerned about this form of risk—usually aged under 35, with two or more children under the age of 12 years, owner occupiers, in social class IIIN (skilled, non-manual), and had lived in the area for less than five years.

When we examine the prompted attitudes towards factory risks the responses were somewhat different from what might have been expected. Whilst it has been noted that up to 42 per cent of the town's population live within 2 km of a major hazard site, the actual level of concern expressed about this was low. For those respondents who did express concern, the main worries were the risk of an explosion and the escape of gas. It seems that for this type of risk people do not make judgements as to the probability of the event but rather the consequence, with the release of gas and explosion being the most severe in terms of the potential for death. A high level of concern was also expressed over the more chronic risks posed by the chemical industry, that is, health effects caused by accidental exposure to various pollutants. Those people having a chemical worker in the family showed the greatest concern about general factory risks. Other factors which seemed to affect the respondent's concern were, being aged under 35, having no children, driving a car, having been a resident under five years, belonging to the non-manual social classes, and being owner occupiers.

DISCUSSION

If we now take the above brief account as one example of an attitudinal survey and its findings, a number of points become clear from the perspective of public policy-making. First of all, evidence such as the above emphasizes the inadequacy of simply guessing at public opinions. What might cause great concern for an outsider (in terms of overall risk levels) can be accepted by local inhabitants as a consequence of tradition, repeated exposure to the hazards in question (although this fact can never be a justification for regulatory inactivity) and, of course, financial benefit in terms of employment. In this case concern certainly does exist among local inhabitants—particularly over traffic—*despite* the routine and ever-present nature of the hazards of the area.

What the survey also suggests is that hazards are seen in specific contexts—the questionnaire encouraged thought not about 'chemical risks' in the abstract but rather about familiar technologies in the immediate environment. Risks are seen as one dimension of an overall technology and the local nature of the study reflected this identification of known industries and production processes. Survey evidence can, therefore, capture the feeling of a specific locality rather than attempt to judge national, and more generalized, attitudes. Furthermore, we would argue that it is more significant to examine the attitudes and responses of those people who are actually exposed to specific risks than using groups who are more remote from a hazard. It seems futile to devise intricate surveys and then to question 'representative' groups on a wide spectrum of potential hazards many of which may not seem pertinent to the respondents (e.g., mountaineering, hang-gliding, etc.). Whilst these sorts of surveys tell us something about the way in which people rank certain risks in relation to others they do not offer so much in the way of useful information which can then be fed into the decision-making process over specific issues. It is possible, therefore, to argue that in order to gain a meaningful insight into people's

attitudes to risk it is necessary to study the responses made by the public to day-to-day hazards encountered within a defined geographical area.

Thirdly, it can be seen from the Halton survey that even at this local level the 'general public' does not exist as a homogeneous entity but instead is diverse and divided by such factors as social class, specific dwelling, occupation and length of residence. Care needs to be taken, therefore, by both social scientists and decision-makers in making over-generalizations (even within specific locations) about 'community attitudes' towards risk. However, surveys can serve to identify the particular worries and fears of certain social groups who, as we have already suggested, may be less articulate in expressing these uncertainties than other sections of society.

As a fourth point, the vocabulary and uniformity of questioning is of importance, especially when the survey is to be carried out by more than one interviewer. It is essential, therefore, that the questions asked are phrased in the language used by the respondents¹⁹ and also structured in a way that will discourage rephrasing and so reduce interviewer bias. In order to become familiar with the words that people use when discussing risk, a group interview was conducted prior to the pilot survey. This was carried out in St Helens rather than Halton so as to prevent the respondents from becoming preconditioned towards the survey.

These essentially positive comments on attitudinal surveys need, however, to be balanced against some of the potential pitfalls. There is an obvious danger that a badly designed or conducted survey can produce misleading information—particular care is needed with 'prompted' questions and the choice of terminology. In addition, the interpretation put on data can, as in other areas of empirical research, vary between analysts. It is perhaps partly for these reasons that survey data—like that from public opinion polls in general—is often viewed with strong suspicion by involved parties. More profoundly, the notion of an 'attitude' can also be questioned. What weight can be given to such half-formed notions amongst people who may never have given serious thought to the topic in question? Can the decision-maker act with confidence when these attitudes may change rapidly and without warning? Furthermore, one can ask legitimately whether such surveys *reflect* or *create* attitudes towards specific hazards.

A critical approach to risk perception studies and to the very notion of 'risk perception' itself can be developed further by the argument that 'risk' as a concept cannot be divided off from the underlying technological and political systems which prevail in any society. In this way, studies of risk divert attention away from the real questions which must be raised:

... the study of risk, its perception, and the search for its underlying dimensions has become a panacea with which to address a set of social problems that go far beyond the relatively straightforward statements usually associated with the idea of risk.²⁰

For the residents of Halton, therefore, the risks of road traffic accidents and the chemical industry can only be evaluated when put into the full local context of social class, employment opportunities, hopes for the future, present anxieties, level of affluence and relative political power.

In short, lay publics understand societal risks and benefits in just the same complex terms as any other part of their lives. It therefore seems inappropriate to carve out a research area of 'risk perception' as something that is any more accessible, measurable, or open to manipulation in the service of policy-making than any other aspect of people's meaningful experience.²⁰

These points should be readily accepted in as much as they emphasize the *social* nature of risk perception and the diverse influences over individual perceptions and attitudes. They also underline the point that a hazardous environment may well be a reflection of social powerlessness, so that the ultimate question is not one of risk *per se* but of political influence and the relative access to this held by particular social groups. However, this broader comprehension of the 'risk' concept does not diminish the argument that survey information can be invaluable in highlighting popular concerns and predicting the reactions of specific groups to individual regulatory decisions.

On a related theme, there is also the suggestion that survey data may be used to identify 'perceptual errors' amongst the public with a view to correcting such 'misperceptions' by propaganda or persuasion. There is some evidence that the original motivation behind much risk perception research in the 1960s and 1970s was indeed to explain public 'irrationality' as suggested by the mismatch between expert risk estimations and those of the public. This approach ignores both the disagreement which can exist between experts over levels of risk (e.g., over the contribution of chemicals to cancer causation)²¹ but also the range of influences over public perception of which statistical frequency may be just one small part. Public perceptions may, therefore, be not so much 'irrational' as more encompassing in their scope than those of narrowly trained technical experts. Accordingly, any attempt to employ survey data as evidence of a misguided, uninformed or inherently fickle citizenry should be treated with enormous suspicion.

As a further, but closely related point it can be argued that a definite threat will arise from attitudinal surveys of data of the type collected in Halton being used to short-circuit the democratic decision-making process. There is an obvious danger that social scientists could become the main sounding board for regulatory authorities and in so doing reduce the perceived need for direct consultation. A new technocracy could find a place within Risk Assessment and this might provide an alternative to the costs and frustrations for regulators and industry of sustained public debate. This threat is all the greater because of the underdevelopment of the field of psychometric studies and the lack of agreement on appropriate survey techniques.

These points about attitudinal survey all suggest that, whilst such data can be a valuable resource, considerable care and further discussion is needed before this resource can be used to best effect. One issue which needs special consideration concerns how data can be made more relevant, and hence more valuable, to concerned groups. How, for example, in the case of the Halton survey should involved parties react to the proposition that the level of concern over road traffic accidents was greatest amongst those 'aged under 35, with two or more children under the age of 12 years' and belonging to a specific social class and with a certain term of residence? The survey illustrates well how such sub-groups can be identified, but how can such an identification lead to improved decision-making? For the researcher, an awareness of this problem may lead to an active discussion with local groups over the type of survey which *they* would find most useful—although this would lead to obvious problems for academic objectivity and sample bias. For those parties to the decision-making process, there may be a concomitant need to recognize the contribution which well-designed and carefully conducted attitudinal surveys can make as a complement—or possibly an antidote—to personal and more anecdotal estimations of public concern. For studies such as that at Halton to have any real effect in policy-making terms an effort must be made, therefore, both by political figures and researchers to reconsider the status and potential value of attitudinal surveys. However, it is only by discussion and negotiation between such groups that knowledge can be made 'usable' as well as honest and reliable.

It could be argued, in conclusion, that the best role for attitudinal surveys is for their results to be employed as *one* source of information for decisions over hazard control—perhaps as an integral part of a larger environmental impact assessment.²² Such a broad review of the scale of threat involved, the costs and benefits of regulation and present attitudes and anxieties could then serve as a basis for informed public debate. In particular, the publication of attitudinal evidence can be invaluable in stimulating the development of local-level discussion and hence the presentation of considered views and proposals. In this way, the feedback relationship between attitudes and survey data can be harnessed in a constructive fashion and not one which leads to public suspicion and alienation. The possibilities for a constructive use of risk attitudinal data in decision-making certainly exist—what is needed now is a sustained discussion of both the potential threats and promises so as to ensure the most advantageous outcome for those concerned and especially for the potential victims of any hazard.

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